UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SUMMARY REVIEW OF MONTHLY REPORTS[1] FOR SOIL CONSERVATION SERVICE--RESEARCH[2] FEBRUARY 1952

EROSION CONTROL PRACTICES DIVISION

Top and Root Yields (Dry Matter) of Vetch and Austrian Winter Peas from Crop Rotation plots - R. M. Smith, Temple, Tex.

"Top and root yields (dry matter) of vetch and Austrian winter peas from crop rotation plots are as follows:

	Pounds per acre	
	Tops	Roots
Peas	990	816
Vetch	937	640

"These stands and the growth were better than for the past several years. Ground cover varied from 25 to 50 percent of perfect, being distinctly higher for the peas than for the vetch. Total nitrogen in the roots is estimated as 15 to 20 pounds and in the tops, 25 to 30 pounds per acre. Roots penetrated well to more than 1 foot, and showed good nodulation. Dry weather following establishment in September probably permitted or favored root development to considerable depth even though a moderately firm plow pan was present."

Corn Yields Obtained on Very Poor Sandy Land, Pierce County Demonstration Farm - F. L. Duley, Lincoln, Nebr.

"Some of the corn yields obtained on the very poor sandy land on the Pierce County Demonstration Farm show the possibilities for improvement in yield of corn.

"The sweet clover and lespedeza were very poor in 1950 on the unfertilized areas and consequently did not show an increase in yield. The decrease on these plots from the check yield probably was due mainly to soil variation. It will be noted, however, that the untreated check gave only 15.9 bushels while the treated vetch plot made 46.6 or an increase of 30.7 bushels. The vetch land was affected less by the lime and phosphate than any other treatment. The vetch made nearly as much growth in 1950 on the no-fertilized plot as on the lime and phosphate areas. Vetch and partridge peas are the two legumes that make almost normal growth on these sandy soils without any special soil treatment. The growth of all legumes in 1951 was superior to that in 1950. If conditions are favorable in 1952 the effect of legumes should show more increase on corn than during last year."

Effect of Applied Winter Mulch and a Cover Crop on Crop Yields - G. D. Brill, New Brunswick, N. J.

"The value of winter protection in the form of mulches and cover crops as a

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[2]All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

means of improving soil structure is becoming well recognized. In 1948 we began a study to investigate the effect of winter mulch and a cover crop on physical properties of the soil, earthworm population, and crop yields. Treatments consisted of a check with the soil left bare in winter, a winter cover crop of wheat or rye, and a surface mulch applied after harvest. The mulch application consisted of about 4 tons per acre of poor quality grass hay. This was removed before plowing in some cases and plowed under in others.

"Field corn and potatoes have been grown continuously on these areas for the past 3 years. Yields of these crops are shown in the following table:

Table 1.--Effect of cover crop and winter mulch on crop yields

Treatment	Yield in bu. per acre			
	1949	1950	1951	3-yr. Ave.
POTATOES				
Check	96	262	300	219
Cover crop	133	279	289	234
Winter mulch (removed)	146	317	291	251
Winter mulch (plowed under)	133	246	305	228
FIELD CORN				
Check	70	56	67	64
Cover crop	78	78	78	78
Winter mulch (removed)	82	87	80	83
Winter mulch (plowed under)	86	86	79	84

"All three treatments increased the yield of corn. Potato yields were more variable but showed some response to treatment in 2 of the 3 years. Removing the mulch before plowing did not materially affect the yield of corn and increased the yield of potatoes in some years."

Effect of Mulches and Benching on Soil-Moisture Conditions and Tobacco Yields - J. Vincente-Chandler, Rio Piedras, Puerto Rico

"The experiment at Utuado dealing with the effect of mulches and benching on soil-moisture conditions and tobacco yields has been terminated. The results are being summarized and will be presented in the next progress report. Apparently mulching helped to maintain higher moisture levels in the upper layers of soil during the course of the experiment. Throughout the trials the soil on the flat section of the broad-bench (cliff) terraces had more moisture at both 6-inch and 24-inch depths than that in the narrow terraces or in the normal slopes. There was no appreciable difference between the latter two."

Number of Fescue Plants Per Square Foot and Per Acre as a Result of Different Seeding Dates - E. C. Richardson, Auburn, Ala.

" On January 17, 1952, a count was made in each of the fescue plots to determine the number of plants per square foot and per acre on each of the seeding dates. Results of this count are shown in the table which appears on the next page.

"From the table it may be seen that the best stand of plants was obtained from the October seeding date. On this date approximately 3 million plants were

retained per acre. September and December produced about 1 million plants per acre. March, August, and November produced about 1/2 million plants per acre. No plants were retained from the June and July seedings and only a few plants from the April seeding. Plants came up from the June and July seeding dates but were killed by dry weather and weed competition during the summer months."

Table 1.--Number of Fescue Plants Per Square Foot and Per Acre as a Result of Different Seeding Dates

Date of seeding 1951	Average number of plants per square foot	Average number of plants per acre
March	9.6	418,176
April	2.0	87,120
May	.4	17,424
June	0	0
July	0	0
August	9.5	413,820
September	24.0	1,045,440
October	73.0	3,179,880
November	12.0	522,720
December	34.0	1,481,040

Stubble Mulch - C. J. Whitfield, Amarillo, Tex.

"Some legume top and root material was recently incubated over moist soil acres at room temperature for a 2-month period. Plant material equivalent to 10,000 pounds per acre was used in the study. The tops of the cylinders containing the cores and mulch were covered with glass plates so the atmosphere above the soil was always very humid. Moisture evaporating from the bottom of the cores was replenished weekly by adding water through the mulch on top of the cores. Although not actually incorporated in the soil, up to three-fourths of the weight of the legume tops and one-half of the dry weight of the roots were lost during the 2 months' incubation. (Table 1). Hubam clover tops seemed to be relatively resistant to decay."

Table 1.--Change in weight of legume tops and roots during 2 months' incubation over moist soil

Material	Dry weight - grams	
	Original	Final
Madrid clover tops	42.4	12.3
Hubam clover tops	42.4	22.5
Hairy vetch tops	42.4	10.3
Austrian winter pea tops	42.4	14.5
Madrid clover roots	42.4	20.0
Hubam clover roots	42.4	20.0

Evapo-transpiration Rates for Bluegrass Pasture 7 - D. D. Smith, Columbia, Mo.

"Evapo-transpiration rates for bluegrass Pasture 7 have been determined the last two summers by C. M. Woodruff of the Soils Department by use of soil-moisture sample data that he has secured and the rainfall and runoff records from the pasture. This pasture has an excellent stand of bluegrass. It has been amply fertilized and receives 100 lbs. per acre of ammonium nitrate in the spring and in the fall. Evapo-transpiration was highest during July 1951, the month of least rainfall. The average for the three summer months of 1951 was the same as for 1950. Average daily rates in inches by months with evaporation-seepage losses for the two experiment farm reservoirs are as follows:"

	Loss in inches per day		
Month	Pasture No. 7	16-acre reservoir	1-acre reservoir
June	0.10	0.15	0.20
July	.17	.18	.25
August	.12	.15	.24
September	.14	.14	.19

Winter Grazing - B. H. Hendrickson, Watkinsville, Ga.

"The last 3 to 6 years' winter grazing records - November-February 4-month period - indicating the number of cow units per acre of full feed grazing provided for beef cattle in station trial pastures show the following trends:

		Winter grazing C.U./ac.
Pasture 5.	Oats, crimson clover-ryegrass temporary pasture	52.9
" 2.	(Kudzu) oats, crimson clover, ryegrass, vetch	51.2
" 6.	(Kudzu) rescue grass	49.2
12.	Ky. fescue seed field	47.5
	4-month average	48.6

"These pastures have a carrying capacity approximating 12 cow units per acre monthly during the winter months. This rate requires about 2-1/2 acres per cow unit for full pasturage, in average winter seasons.

"However, the amounts of winter grazing provided by winter annuals have fluctuated widely, depending on winter minimum temperatures. For example, Pasture 5 provided 136 cow units per acre during the mild winter of 1946-47, but only 14.2 cow units per acre during the severely cold winter of 1950-51.

"If the perennials, as in Pastures 6 and 12, are reasonably well managed, our records show that they are much more dependable, through both winter freezes and summer droughts, for supplying good winter grazing at about the rate above indicated."

Top Growth and Root Growth Samples of Sweet Clover-grass at Various Stages of Growth - F. H. Siddoway, St. Anthony, Idaho

"Last summer top growth and root growth samples of sweet clover-grass were taken at various stages of growth. The results are listed in the following table:

Table 1.--Pounds per acre dry matter and nitrogen produced at four different heights of plowing sweet clover-grass green manure crop

Height of sweet cl-grass : Inches	Sw cl-gr tops : Dry matter : lbs/ac	Sw cl-gr tops : Nitrogen : lbs/ac	Sw cl-gr roots : Dry matter : lbs/ac	Sw cl-gr roots : Nitrogen : lbs/ac	Total : Dry matter : lbs/ac	Total : Nitrogen : lbs/ac
6	2,057	59	960	13	3,017	72
12-14	3,823	111	1,215	17	5,038	128
20-22	7,163	183	1,535	20	8,698	203
34-36	6,776	154	1,920	25	8,696	179

"The weight and total nitrogen content of the sweet clover-grass top and root growth increased up to the third height. Pounds of tops and roots per acre was the same for the last two heights although the total nitrogen content for the 34 to 36-inch height was 24 pounds less than the 20-22-inch height. Percent nitrogen of top growth remained about the same for the two shorter heights and decreased in the taller two heights. Nitrogen percentage remained fairly constant for all samplings of root growth.

"The first two heights are the only ones that are practical if a crop is to be grown the year following the utilization of the sweet clover-grass as a green manure. The last two heights deplete practically all of the reserve moisture and a year of fallow is necessary before a crop can be grown.

"Assuming all of this nitrogen is returned to the soil and is not lost by leaching, runoff, or in other ways, the sweet clover-grass plowed at the 6-inch height supplies enough nitrogen to meet the needs of a 45-bushel grain crop. This would be enough nitrogen in our rainfall area to supply almost enough nitrogen for two grain crops. The other heights can be calculated accordingly.

"Figured at the present cost of ammonium nitrate, the nitrogen supplied by the sweet clover crop is worth $10.44, $18.56, $29.43, and $25.96 per acre for the respective heights."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio

"Precipitation of 2.32 inches, mostly in the form of rain caused some runoff from small watersheds. The greatest total was 0.68 inch from the soil of lowest permeability. Maximum frost penetration of 5 inches on the wheat and 2 inches on the meadow occurred during the period of no runoff. Stream flow from the 303-acre watershed totaled 2.08 inches for the month--coming mostly from seepage flow.

"Mr. Dreibelbis reports that in analyzing the data on surface runoff for January 1952, there appeared to be no correlation of slope with surface runoff and little correlation of land use with runoff. There was, however, an excellent correlation of soil type effects on surface runoff as shown in table 1.

Table 1.--Soil-type effects on surface runoff from small watersheds January 1952

Watershed No.	Area	Soil type	Slope %	Land use	Practice	Surface runoff (inches) Storm of Jan. 26, 27	Surface runoff (inches) Totals for January
	Acres						
103	0.65	Keene silt loam	11.3	Rotation meadow	Cons.	1.86	2.01
110	1.27	-do-	13.0	-do-	Poor	1.16	1.26
123	1.37	-do-	5.8	-do-	Cons.	2.03	2.13
127	1.65	-do-	10.0	-do-	Cons.	2.78	3.40
Average		-do-	10.0	-do-		1.96	2.20
106	1.56	Musk. silt loam	14.3	-do-	Poor	0.59	0.71
109	1.69	-do-	12.7	-do-	Cons.	.05	.05
121	1.42	-do-	15.8	-do-	Cons.	.83	.96
130	1.63	-do-	21.7	Permanent mead.	Cons.	.39	.39
Average		-do	16.1	Meadow		.47	.53
111	1.18	Keene silt loam	7.5	Wheat	Cons.	2.60	3.28
113	1.45	Cosh. silt loam	9.3	Wheat	Cons.	1.29	1.35
118	1.96	-do-	9.6	Wheat	Poor	1.92	2.36
131	2.21	Muskingum loam	21.6	Woodland	Cons.	0.22	0.22
132	.59	Keene silt loam	12.0	Woodland	Cons.	.48	.55

"For the storm of January 26 and 27, the four meadow watersheds on Keene silt loam had an average runoff of 1.96 inches while the four meadow watersheds on Muskingum silt loam had only 0.47 inch. The data for the entire month of January showed similar values, namely, 2.20 inches and 0.53 inch for the Keene silt loam and Muskingum silt loam watersheds respectively. There was not a single exception to this trend. Even the slopes were greater on the watersheds with the lesser runoff--the Keene watersheds averaging 10.0 percent and the Muskingum watershed 16.1 percent.

"The same relationship appeared on the woodland watershed. While runoff was very low on the woodland areas, yet the Keene watershed had more than twice the amount of runoff than on the Muskingum.

"Two of the watersheds in wheat on the Coshocton silt loam had less runoff than some of the meadow watersheds on Keene silt loam.

"This contrast in runoff appears only during the winter and early spring. At this time soil moisture is often above field capacity on the Keene silt loam but on the Muskingum areas it drains away readily. When storms of low intensity occur the Keene profile is soon saturated and runoff appears. On the Muskingum areas most of the rainfall infiltrates in the soil because the good drainage provides available storage space for most of the rainfall. In the Keene subsoil the large amount of colloids swell sufficiently to make the subsoil almost impermeable. Consequently, a large storm will soon produce runoff because the available storage

space is soon exhausted. During the growing season this does not occur because high evapo-transpiration rates provide enough available storage space so that runoff rates and amounts on all meadow watersheds regardless of soil type, are generally rather low."

Hydrologic Studies - R. W. Baird, Blacklands Experimental Watershed, Waco, Tex.

"Rainfall for the month of February totaled 2.79 inches at Gate No. 69 compared to the normal of 2.37 inches. This is the first time that rainfall has been equal to or greater than normal since September 1951. The rains of February did not include any storms of runoff-producing characteristics, the largest rain being one of about 1.36 inches February 24 and 25. This rain continued over a period of almost 24 hours, and the rates were low throughout the entire period. No runoff was measured from any of these rains. Rainfall has been sufficient to make satisfactory growing conditions for winter crops.

"Work has been continued on the preparation of the runoff summary for the 12-year period 1940-51. The summarized runoff records are now complete and in process of being mimeographed. Some work remains to be done on the preparation of weighted rainfall tables to accompany this runoff summary."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebr.

"February was unusually mild with an average temperature of 34.8 degrees which is 7.2 degrees above the long-time average. There were only 4 days during the month when the maximum temperatures were below 32 degrees. There were also 4 days when the minimum temperatures were above freezing."

Hydrologic Studies - R. B. Hickok, Lafayette, Ind.

"Mr. Stoltenberg has prepared the following additional notes on the selective loss of plant nutrients by erosion:

"In the evaluation of losses of phosphorus and potassium by erosion, the method of analysis is a prime consideration. Elemental analyses of eroded material may be quite misleading as these elements are for the most part in forms unavailable or slowly available to growing plants. The importance of losses of elemental P and K may be further questioned where the subsoil contains large reserves of one or both of these elements. Baver (SSSA Proc. 15: p. 5. 1950) as well as others have justly criticized the overemphasis that has been placed on elemental losses of P and K.

"On the other hand, methods which include only the immediately available forms of these elements may distort the picture the other way. For instance, the amount of potassium as determ ned by the Truog method has been found to correlate negatively with the amount of soil in the runoff, probably due to the high mobility of this fraction and its inclusion with infiltrated water.

"The mean composition of surface soil from six prevailing-practice and six conservation-practice watersheds is given in table 1, page 8. The mean composition of the eroded material from each set of watersheds under the two farming practices is also given in table 1.

"This table is a key to the insidious nature of the erosion process. The eroded material contains considerably more organic matter and plant nutrients than the soil from which it was eroded. These differences were found to be highly significant when analyzed statistically on an individual watershed basis.

"The higher analyses of the eroded material from the conservation-practice watersheds reflects their higher fertility level, resulting primarily from a high level of fertilization. Despite the higher concentration of plant nutrients in the eroded material from the conservation-practice watersheds, these practices have resulted in a substantial saving in soil and plant nutrients (see January 1952 report). These data emphasize the importance of control of surface runoff when fertilizing heavily. Further details of the selective erosion process will be discussed in a subsequent report."

Table 1.--Analysis of soil and eroded material, Purdue-Throckmorton Farm 1947-50

Practices	Percent by weight*				
	O.M.	N.	*P_2O_5	+K_2O	$CaCO_3$ and $MgCO_3$
Prevailing practices:					
Surface soil	3.33	0.158	0.051	0.010	1.02
Eroded material	4.13	.275	.093	.073	1.52
Conservation practices:					
Surface soil	3.58	.168	.058	.012	1.09
Eroded material	4.93	.349	.118	.152	2.09

*Each figure is the average from six watersheds.
+In forms readily available to growing crops.

Hydrologic Studies - A. W. Cooper, Auburn, Ala.

"The February rainfall of 4.14 inches represents 76 percent of the 71-year average of 5.43 inches for Auburn.

"One rain of 1.63 inches caused a small amount of water loss from the erosion plots (table 1). There was no soil loss from the plots. There is no explanation for the relatively high water loss on plot 5. The plot was examined carefully for possible water running in from outside the plot, but no evidence was found of this.

"Mechanical analyses of soils determined this month are given in table 2.

"Considerable time was spent during this month in planning plot work to be initiated this summer to determine the consumptive-use of corn, cotton, and pasture and in getting physical facilities ready to start the work. A new weather station site was leveled and fenced. A standard and a recording rain gage, a hygrothermograph, and evaporation pans (one on land and one in a pond) were set up." The above tables appear on the next page.

Table 1.--Water losses from erosion plots, Auburn, Ala.

Plot No.	Slope %	Vegetative cover	Rainfall - 1.63 inches 2/26/52 water loss inches
1	2-1/2	Alfalfa	0
2	5	Crimson and rye	0
3	5	Crimson and rye	.36
4	5	Cornstalks	.27
5	10	Fescue and ladino	.75
6	10	Cornstalks	.40
7	10	Fescue and ladino	.16
8	10	Crimson	0
9	20	Crimson and cornstalks	0
10	20	Crimson and cornstalks	0

Table 2.--Mechanical analyses of Alabama Soils*

Particle Size Mm	Description	Irvington - depth 0"-3"	9"-12"	22"-25"
		Corrected average Percent		
4-2	Gravel	17.97	11.94	11.35
2-1	Fine gravel	.29	.35	.49
1-.5	Coarse sand	1.66	1.70	1.72
.5-.25	Medium sand	6.85	6.96	6.57
.25-.1	Fine sand	22.33	23.62	23.86
.1-.05	Very fine sand	9.56	10.34	11.04
.05-.005	Silt	26.64	30.87	27.90
<.005	Clay	9.40	8.23	15.66
	Total	100.00	100.00	100.00

		Norfolk - depth 0"-8"	8"-22"
		Corrected average Percent	
4-2	Gravel	0.00	0.00
2-1	Fine gravel	3.13	2.41
1-.5	Coarse sand	3.80	9.24
.5-.25	Medium sand	28.15	23.63
.25-.1	Fine sand	29.03	31.49
.1-.05	Very fine sand	11.39	12.32
.05-.005	Silt	7.28	9.37
<.005	Clay	17.22	11.54
	Total	100.00	100.00

Table 2.--Mechanical analyses of Alabama soils--Continued

Particle Size Mm.	Description	Greenville - depth 1"-4"	12"-15"	24"-27"
		Corrected average Percent		
4-2	Gravel	0.00	0.00	0.00
2-1	Fine gravel	6.67	5.84	7.40
1-.5	Coarse sand	7.23	5.85	6.19
.5-.25	Medium sand	15.82	12.57	12.26
.25-.1	Fine sand	24.20	19.55	18.71
.1-.05	Very fine sand	13.36	11.14	10.99
.05-.005	Silt	17.22	18.85	18.95
<.005	Clay	15.50	26.20	25.50
	Total	100.00	100.00	100.00

		Ruston - depth 0"-3"	12"-15"	20"-23"
		Corrected average Percent		
4-2	Gravel	0.82	1.21	1.03
2-1	Fine gravel	1.03	.72	.80
1-.5	Coarse sand	4.33	3.25	3.76
.5-.25	Medium sand	18.03	16.08	16.84
.25-.1	Fine sand	48.68	48.58	48.25
.1-.05	Very fine sand	10.94	12.48	10.69
.05-.002	Silt	11.42	11.06	10.89
<.002	Clay	4.75	6.62	7.73
	Total	100.00	100.00	100.00

		Marlboro - Depth 0"-3"	6"-9"	20"-23"	30"-33"
		Corrected average Percent			
4-2	Gravel	0.82	1.62	0.45	0.73
2-1	Fine gravel	1.49	1.30	1.53	1.43
1-.5	Coarse sand	4.89	4.52	5.22	5.73
.5-.25	Medium sand	10.82	10.18	11.69	11.15
.25-.1	Fine sand	18.71	17.08	17.97	16.32
.1-.05	Very fine sand	26.87	25.56	23.92	24.53
.05-.005	Silt	27.67	24.20	23.89	24.32
<.005	Clay	8.73	15.54	15.33	15.79
	Total	100.00	100.00	100.00	100.00

Table 2.--Mechanical analyses of Alabama soils--Continued

Particle Size Mm.	Description	Huntington - depth 0-3"	7"-10"	11"-14"
		Corrected average Percent		
4-2	Gravel	0.00	0.00	0.00
2-1	Fine gravel	1.96	2.18	2.84
1-.5	Coarse sand	1.93	1.77	2.30
.5-.25	Medium sand	2.87	2.63	2.67
.25-.1	Fine sand	5.56	5.16	2.10
.1-.05	Very fine sand	13.08	12.66	7.89
.05-.005	Silt	56.50	53.60	52.80
.005	Clay	18.10	22.60	29.40
	Total	100.00	100.00	100.00

Textural classification as determined by mechanical analysis.

Irvington: Sandy loam - all levels tested.
Norfolk: Sandy loam - all levels tested.
Greenville: 1"-4" - sandy loam; 12"-15" - sandy clay loam; 24"-27" - sandy clay loam.
Ruston: Loamy sand - all levels tested.
Marlboro: Sandy loam - all levels tested.
Huntington: 0"-3" - silt loam; 7"-10" - silt loam; 11"-14" silty clay loam.

Data obtained jointly by SCS Research and Operations

Hydrologic Studies - G. A. Crabb, Jr., East Lansing, Mich.

"During the latter part of the month, a highly interesting publication was released by the Michigan Agricultural Experiment Station. This was 'A Summary of Weather Conditions at East Lansing, Michigan, Prior to 1950,' by W. D. Baten, Experiment Station Statistician, and A. H. Eichmeier, Director of the Michigan Section of the U. S. Weather Bureau. The Research Station has been actively interested in the studies leading up to this publication for several years, and cooperated through the release and preparation of data in this particular study. The summary graphically presents cumulative weather information for a considerable period of years from the various source installations at East Lansing. Full credit was given to the Research Station in the publication for use of its data. The authors have very kindly given permission to the Station to utilize all data from the summary in our own research program. Because of the wide need for the information summarized, it has been recommended to Operations that copies of the summary be placed in each office of the Soil Conservation Service in Michigan. It is felt that these data will be of particular value in interpreting agricultural research data, and in making crop recommendations. For our own part, the Research Station plans to utilize this information widely for comparative purposes in relating hydrologic phenomena."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.

"Mr. Donnelly spent some time analyzing the results of his straight drop spillway tests. He has tentatively determined that the required heights of end sill must vary from about 1.3 to 1.9 critical depths depending on the head over the spillway. This determination is for a high overfall. He is now checking the required tailwater using lower overfalls.

"With regard to the floor blocks and the longitudinal and end sills, Mr. Donnelly has not yet been able to devise a means of showing the best dimensions of these elements. The relationships between the variables are quite complex so the selection of the best dimensions has to date been largely a matter of judgment."

Supplemental Irrigation Studies - J. R. Carreker, Athens, Ga.

William B. Land and Carlisle Cobb, Jr., presented papers at the Southeast Section of American Society of Agricultural Engineers meeting in Atlanta February 4. Land reported on, 'Moisture Withdrawal by Tomatoes Under Three Levels of Soil Moisture,' while Cobb discussed 'The Measurement of Tomato Roots Grown Under Three Levels of Soil Moisture.' The work carried out in 1951 on this project was the basis of these discussions. Plans were made to continue these studies in 1952."

Drainage Studies - M. H. Gallatin, Homestead, Fla.

"With rains occurring on the 2, 3, 5, 16, 17, 26, and 27, readings on all the mulch plots, except the natural cover plot, remained quite low during the period. Readings on the natural cover block increased during the period February 5 to February 16 and slightly toward the end of the period. There is a noticeable decomposition or breakdown of the shavings material but as yet sampling of the plot areas shows no release of nitrate. Apparently if there is a release it is being used by the organisms existing in this layer. Analysis of samples from the grass and pine straw mulched area show 54 ppm nitrate for the pine straw mulch and 99.0 ppm for the grass-mulch area. Examination of the soil material of the various plots show the soil under the grass and pine mulch to be dark brown in color and pliable while the check plot area is almost red in color. It dries out to a hard compact material. The soil material under the shavings block is grayish brown and remains sticky to the feel. The soil material in the natural cover area is in fair condition, though there has been no buildup of the organic matter.

"Results of the first year's work on the moisture plots seem outstanding. This study was set up to study the rate and cycle of application of irrigation water. Eight blocks of trees approximately 20 acres in each block are included in this study, five blocks of which were limes and three of avacados. The rate of application of water was as follows; and was adhered to fairly closely by the cooperator: Block 2 limes, 1 inch per week; block 4 check; block 6 one-half inch twice a week; block 8 one-half inch per week; and block 10 to be irrigated on cycle as determined by making moisture readings with sufficient frequency. This block was irrigated when the level about reached the wilting point 18 - 20 percent. The results are as follows:

Block 2 produced 0.266 box of fruit per tree; block 4, 0.252 box per tree; block 6, 0.234 box per tree; block 8, 0.224 box per tree and block 10, 0.434 box per tree. It will be noted that production in the cycle block was nearly doubled that of any of the other blocks. It will also

be noted that bloom first appeared in block 10 cycle followed by block 2, 1 inch per week. Bloom appeared 12 - 14 days earlier on these blocks than the check block.

"Results of the first year's study on the avacado block are more or less the same as the lime block. Block 3 cycle produced 0.615 box of fruit per tree; block 5 check 0.468 box, and block 7 one inch every 2 weeks 0.557 box per tree. As will be noted the cycle block produced the greatest amount of fruit.

"Indication of the previous and past year's work is that irrigation if used properly will produce larger amounts of fruit and that water just applied produces little more than areas not irrigated. Our preliminary work in cycle and rate has indicated this but this is the first time we have had production records for comparison.

"Results of the first year's work, in connection with the nitrate leaching studies, on the Princeton plots shows definite indication that when a constant level of nitrate is maintained (30-60 ppm of nitrate), production is higher than in areas where an extremely high level is maintained (100 ppm or more). A tree count of marketable fruit on the plots was as follows. An average of 47 fruit per tree was produced on the high nitrate block against 72 fruit per tree for the block maintained at a constant level. Data at the end of the year indicate, as our preliminary data for the past several years, that production is maintained or increased, when a constant adequate level of nitrogen is maintained.

"It is of course understood that the level P and K as well as the nutritional and other spray program is adequate.

"In connection with the conservation of the marl land, samples have not been collected from our lines in the Homestead and Miami areas during the period but analysis of samples brought into the office by farmers and growers and a field check of the area shows that there has been extensive crop reduction due to high concentrations of chlorides much further to the west than we have ever observed.

"We also noted extensive damage bordering the small farm canals that in most cases are not protected by a barrier. While the apparent damage is adjacent to these ditches there is no doubt that production in the field has been lowered also.

"We are attempting to collect data from fields in which the concentration was high against fields of low concentration."

Drainage Studies - C. B. Gay, Fleming, Ga.

"The Crimson Clover seeded last fall on the 6 acres of Coastal Bermuda and 3 acres of Pensacola Bahia has made a very ununiform growth to date. The stand is good over the entire area of 9 acres, however, the growth is very spotted in that about half of the area supports a very poor growth intermixed with spots of excellent growth. It is difficult to determine yet whether the spots of poor growth are due primarily to lack of fertility or an irregular soil condition on this new land. Even though an average amount of complete fertilizer has been applied some of the minor elements will possibly be necessary. Then too, the spots where the poor growth occurs seem to be excessively wet and shallow field ditches for surface disposal will possibly be necessary."

Muck Drainage Studies - R. B. Hickok, Lafayette, Ind.

"Draw-down measurements and permeability determinations made on controlled drainage plots have been alayzed. Effective permeabilities have been determined from draw-down curves and compared with other methods used for determining permeability in the muck soil. There was good agreement of the draw-down curve permeabilities with those obtained by the core sampler and auger-hole methods.

"The plots which had been drained more deeply and has as a result developed a favorable structure in the subsoil had much higher rates of permeability. Permeability, evapo-transpiration, and depth of tile were all found to be factors in the drainage rate, but permeability proved to be most important.

"A special report on the results of permeability and draw-down studies will be made available to those interested."

Sedimentation Studies - R. Woodburn, State College, Miss.

"Mr. Burford continued his laboratory tests of stability of various gully soils by the method devised by Dr. C. S. Slater. These results were compared with relative erosion losses obtained by use of raindrop splash. Details are covered below:

"In connection with sediment-production rate studies, there has been a need for a measure of absolute erodibility of soil or of relative erodibility between soils.

"An attempt has been made to measure relative erodibility of gully soil material of north Mississippi by means of splash loss with a rain simulator at State College. It was found that materials of high sand content suffer highest splash loss. The splash loss tends to decrease as the clay and silt content increases. High sand materials from gullies in different geologic strata behave in about the same way. In the range from 70 percent sand to 95 percent sand, there is a good relationship between sand content and splash erosion loss. In fact, it appears to be linear. As the sand content drops below 65 percent with the consequent increase in silt and/or clay, erodibility becomes less; however, the relationship is very inconsistent.

"Studies were made on the same soils by means of a technique devised by Slater[1] which gives a measure of aggregate stability of the material. The Slater method is a wet sieving test of the soil sample which separates the percentage of the sample which remains in aggregates larger than 0.5 mm. after 2 minutes of vertical oscillation at a low rate in a water bath. This test which is a measure of stability of the soil undoubtedly will give some indication of erosion susceptibility or conversely resistance to erosion.

"The investigators were anxious to learn if high erosion resistance of a soil measured by its resistance to raindrop energy would also be indicated by the Slater stability test.

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[1]Bryant, J. C., Bendixen, T. W., and Slater, C. S. Measurement of the Water Stability of Soils. Soil Sci. 65: 341-345. 1948.

"The soils are listed in table 1, a copy of which can be procured from the project, together with their mechanical analyses, erosion losses by splash, and percentage of water-stable aggregates by the Slater method.

"The samples used for splash erosion studies were undisturbed soil cores taken in 3-1/2-inch diameter thin wall cylinders 2 inches deep. The Slater tests were run on material that was airdried and crushed for passing a 5 mm. sieve and for retention on a 3 mm. sieve.

"The data are plotted in figure 1 (a copy can be obtained from project) which shows water-stable percentage by Slater tests vs. splash-erosion loss in inches. The very high sand materials were generally very unstable according to the Slater test and also of high erodibility as measured by the rainmaker. It is doubtful if the aggregate percentage is really valid. Sandgrains cemented together behaved as aggregates.

"It may be noted that there is a trend toward lower erodibility as Slater stability increases, however, a number of points are rather widely out of place.

"One disturbing feature of trying to compare the two methods is that of initial condition of the soil sample. The rainmaker tests were run on cores of undisturbed material taken below the zone of surface weathering or fragmentation. In other words, these cores were dense, homogeneous blocks rather representative of a massive formation. On the other hand the Slater tests were run on material which had been crushed to small clod size.

"Two samples of silt material from 8 inches down and from 8 feet down from the Carroll County gully show a rather interesting contrast. They are noted as silt material 8 inches down and mottled silt material respectively. These samples were quite similar in appearance both in cores and in crushed state. Their mechanical analysis did not vary widely from one to the other. They were about the same in erodibility as measured by rainmaker. On the other hand, one sample had 0 percent left on 0.5 mm. sieve and the other had 66 percent by the Slater test.

"It is possible that the rainmaker test may give a valid erodibility comparison between soils in their undisturbed state, and the Slater method may be a good index of erodibility of the same material after it has weathered into a thin layer of loose material at the surface. This interesting point will be pursued further with possible studies of the crushed materials by rainmaker action."

IRRIGATION ENGINEERING AND WATER CONSERVATION DIVISION

Irrigation and Drainage Research in Utah - W. E. Hansen, Logan, Utah

"A paper dealing with the hydraulics of wells has been completed entitled 'Unconfined Ground-Water Flow to Multiple Wells' and will appear soon as a Proceedings Separate published by the American Society of Civil Engineers.

"The purpose of this paper is to clarify the nature of unconfined flow to single and multiple wells, and to present a method of solving problems associated with this type of flow. The effect of the capillary fringe on the location of the free surface and the form of the flow patterns, the zone of validity of the Dupuit equation, the shape of the free surface near the well, and the variation in the stream surface spacing all are discussed. A functional relationship independent of the radius of influence is established, relating the variables at the well;

this relationship applies to both single and multiple wells. A fundamental dimensionless parameter consisting of a ratio of Froude's to Reynolds' numbers is formulated that characterizes the shape of the cone of depression around a well. The concepts of well efficiency and effectiveness are clarified and guides are presented for their correct use.

Soil Piping - K. Harris and H. B. Peterson, Phoenix, Ariz.

"While in Tuscon a paper was written in cooperation with Joel Fletcher to be published in Progressive Agriculture, a quarterly magazine published by the University of Arizona. This paper was on soil piping.

"On February 15, 1952, Fletcher, Chandler, Harris, and Peterson of Research, Soil Conservation Service, made an investigation of the piping conditions present near the San Pedro River area of Benson, Ariz. This piping area extends up and down the river from Benson.

"All the conditions necessary for piping were found in this area. The 20-foot vertical banks of the river act as an outlet for the piped water. The source of supply of the water may come from the many irrigated fields adjacent to the river, or from various washes which feed into the stream. Pipes occur along these washes as well as in the field adjacent to the river. The 20-foot vertical banks along the river gave an excellent opportunity to investigate the soil profile. This investigation showed there were intermittent layers of easily erodible soil overlying heavy bentonite clay layers. These heavy clay layers swelled on contact with water.

"The easily erodible layer had an infiltration rate of about 80 times as fast as that of the tough clay layer below it.

"Water enters the more permeable surface layer at a much faster rate than can the clay layer underlying it take it away. Consequently, a hydrostatic head is built up and the water moves laterally along the retarding layer to the nearest outlet, this being the river bank. As the water moves along this tough clay layer, it causes erosion in the more permeable layer, and consequently, so much material is carried away through underground channels that cave-ins occur.

"Because of the intermittent tough clay layers, there are several depths of piping.

"We can thus see that conditions necessary for piping are:

1. Outlet for piped water.
2. Source of sufficient water supply.
3. Differentially permeable soil.
4. Easily erodible soil overlying the more impermeable layers.
5. A hydrostatic head of water."

Performance Tests of Well Screens - C. Rohwer, Ft. Collins, Colo.

"Tests of the flow of sand into wells with different types of screens were continued. These tests were made in a plastic tube in which the screen, the gravel envelope, and the water-bearing formation were placed in the same position as they would occur in a well. These tests show that until the velocity is great enough to move the sand particles the sand in the aquifer will stay in place, but

when the velocity is increased beyond this critical value, the movement of the sand increases with the velocity. Below this critical velocity the size of gravel in the envelope has little effect on the movement of the sand. However, after the sand begins to move, the higher velocities move more sand through the gravel envelopes of coarser material.

"The report on the Effect of Well Screens on Flow into Wells has been completed and copies have been sent to the cooperators. This report has been submitted for publication in a technical journal."

Replenishment of Underground Aquifers, San Joaquin Valley - D. C. Muckel, Berkeley, Calif.

"Large scale spreading operations by a local water-storage district were inspected at Bakersfield. Water was being spread on approximately 90 acres and construction of additional spreading grounds was under way at two locations. It is planned to have 400 acres of land developed for spreading this spring. About one-half the area is being treated to cotton gin trash. At present this treatment is costing about $240.00 per acre. However, with experience and the development of special equipment, it is hoped to reduce this cost to around $100.00 per acre. The cost of leveling, diking, etc., was estimated at $237.00 per acre making the total cost, at present, amount to $477.00 per acre of spreading ground."

Silt Studies - D. W. Bloodgood, Austin, Tex.

"Silt data for five stations were completed during the month. These data are to be included in the 13th multilithed annual report of The Silt Load of Texas Streams for the water year ending September 30, 1951."

4/7/52